#16 9-6

Unicorns...

(1) $4+w$ by w

$w(4+w) = 30$

$w^2 + 4w = 30$

$w^2 + 4w - 30 = 0$

$a = 1$, $b = 4$, $c = -30$

$\frac{-4 \pm \sqrt{4^2 - 4(1)(-30)}}{2(1)}$

$\frac{-4 \pm \sqrt{16 + 120}}{2}$

$\frac{-4 \pm \sqrt{136}}{2}$

$\frac{-4 + \sqrt{136}}{2} = 3.83$ $\quad$ $\frac{-4 - \sqrt{136}}{2} = -7.83$

$3.83 + 4 = 7.83$

The length is 7.83 m and width is 3.83 m.

(2) $2w-1$ by w

$w(2w-1) = 91$

$2w^2 - w = 91$

$2w^2 - w - 91 = 0$

-182: -14, 13; 2: -7, -1

$(w-7)(2w+13) = 0$

$w = 7$ $\quad$ $w = -13/2$

The width is 7 cm and length is 13 cm.

(3) $3h+2$ by h

$h(3h+2) = 165$

$3h^2 + 2h = 165$

$3h^2 + 2h - 165 = 0$

$a = 3$, $b = 2$, $c = -165$

$\frac{-2 \pm \sqrt{2^2 - 4(3)(-165)}}{2(3)}$

$\frac{-2 \pm \sqrt{4 + 1980}}{6}$

$\frac{-2 \pm \sqrt{1984}}{6}$

$\frac{-2 + \sqrt{1984}}{6} = 7.1$ $\quad$ $\frac{-2 - \sqrt{1984}}{6} = -7.8$

The height is 7.1 ft.

(4) $x+2$ by $x+1$ (x = old side)

$(x+2)(x+1) = 24.75$

$x^2 + 2x + x + 2 = 24.75$

$x^2 + 3x + 2 = 24.75$

$x^2 + 3x - 22.75 = 0$

$a = 1$, $b = 3$, $c = -22.75$

$\frac{-3 \pm \sqrt{3^2 - 4(1)(-22.75)}}{2(1)}$

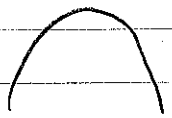
$\frac{-3 \pm \sqrt{9 + 91}}{2}$

$\frac{-3 \pm \sqrt{100}}{2}$

$\frac{-3 + 10}{2} = 3.5$ $\quad$ $\frac{-3 - 10}{2} = -6.5$

The table was 3.5 feet long.

(5) $h = -16t^2 + vt$



$h = -16t^2 + 88t$

$-16t^2 + 88t = 40$

$-16t^2 + 88t - 40 = 0$

$-8(2t^2 - 11t + 5) = 0$

$-8(t-5)(2t-1) = 0$

$-8 \neq 0 \quad t-5=0 \quad 2t-1=0$

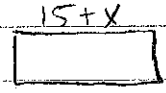
$t = 5 \quad 2t = 1$

$t = \frac{1}{2}$

10 : $-10, -1$; $\frac{-10}{2} = -5$, $\frac{-1}{2}$; $-5 - \frac{1}{2} = -11/2$

It will be at 40 feet at 1/2 sec. and 5 sec.

(6)



$(x+15)(x+8) = 198$

$x^2 + 15x + 8x + 120 = 198$

$x^2 + 23x + 120 = 198$

$x^2 + 23x - 78 = 0$

$(x+26)(x-3) = 0$

$x+26=0 \quad x-3=0$

$x = -26 \quad x = 3$

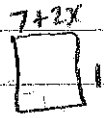
$15+3 = 18$

$8+3 = 11$

-78 : $26, -3$; 23

The new garden is 11 m x 18 m.

(7)



$(2x+7)(2x+10) = 130$

$4x^2 + 14x + 20x + 70 = 130$

$4x^2 + 34x + 70 = 130$

$4x^2 + 34x - 60 = 0$

$2(2x^2 + 17x - 30) = 0$

$2(x+10)(2x-3) = 0$

$2 \neq 0 \quad x = -10 \quad x = 3/2$

-60 : $20, -3$; $\frac{20}{2} = 10$, $\frac{-3}{2}$; $10 + \frac{17}{2}$

The frame is 1.5 in wide.

(8) $h(x) = -x^2 + 6x$

$x = \frac{-b}{2a}$

a) $x = \frac{-6}{2(-1)} = \frac{-6}{-2}$

$x = 3$

b) $h(3) = -(3)^2 + 6(3)$

$h(3) = -9 + 18$

$h(3) = 9$ ft

#7

Italian Insects...

① $h(t) = -16t^2 + vt + c$

$h(t) = -16t^2 + 80t + 4$

$-16t^2 + 80t + 4 = 0$

$-4(4t^2 - 20t - 1) = 0$

$a = 1$, $b = -20$, $c = -1$

$$\frac{20 \pm \sqrt{(-20)^2 - 4(1)(-1)}}{2(4)}$$

$$\frac{20 \pm \sqrt{400 + 4}}{8}$$

$$\frac{20 \pm \sqrt{404}}{8}$$

$\frac{20 + \sqrt{404}}{8} = 5.01$ $\quad$ $\frac{20 - \sqrt{404}}{8} = -0.01$

It will take 5.1 seconds to hit the ground.

② $h(t) = -16t^2 + vt + c$

$h(t) = -16t^2 + 80 + 4$

$-16t^2 + 80t + 4 = 100$

$-16t^2 + 80t - 96 = 0$

$-16(t^2 - 5t + 6) = 0$

$-16(t-2)(t-3) = 0$

$-16 \neq 0$ $\quad t - 2 = 0$ $\quad t - 3 = 0$

$t = 2$ $\quad t = 3$

It will reach 100 ft after 2 and 3 seconds

③ $h(t) = -16t^2 + vt + c$

$h(t) = -16t^2 + 20t + 6$

$-16t^2 + 20t + 6 = 10$

$-16t^2 + 20t - 4 = 0$

$-4(4t^2 - 5t + 1) = 0$

$-4(t-1)(4t-1) = 0$

$-4 \neq 0$ $\quad t - 1 = 0$ $\quad 4t - 1 = 0$

$t = 1$ $\quad t = 1/4$

It will reach 10 ft. on its way down at 1 second.

* 1/4 second is on its way up.

④ $h(t) = -16t^2 + vt + c$

$h(t) = -16t^2 + 27t + 2.5$

$-16t^2 + 27t + 2.5 = 3.5$

$-16t^2 + 27t - 1 = 0$

$a = -16$, $b = 27$, $c = -1$

$$\frac{-27 \pm \sqrt{27^2 - 4(-16)(-1)}}{2(-16)}$$

$$\frac{-27 \pm \sqrt{729 - 64}}{-32}$$

$$\frac{-27 \pm \sqrt{665}}{-32}$$

$\frac{-27 + \sqrt{665}}{-32} = 0.38$ $\quad$ $\frac{-27 - \sqrt{665}}{-32} = 1.65$

1.45 seconds go by.

⑤ $h(d) = -0.02d^2 + 1.1d + 4$

$-0.02d^2 + 1.1d + 4 = 0$

$a = -0.02$

$b = 1.1$

$c = 4$

$$\frac{-1.1 \pm \sqrt{(1.1)^2 - 4(-0.02)(4)}}{2(-.02)}$$

$$\frac{-1.1 \pm \sqrt{1.21 + .48}}{-.04}$$

$$\frac{-1.1 \pm \sqrt{1.69}}{-.04}$$

$$\frac{-1.1 + \sqrt{1.69}}{-.04} \qquad \frac{-1.1 - \sqrt{1.69}}{-.04}$$

$= -\cancel{5}$ $\qquad = 40$

The shot travels 60 feet.

⑥ $h(d) = -0.015d^2 + 1.8d + 2$

$-0.015d^2 + 1.8d + 2 = 0$

$a = -0.015$

$b = 1.8$

$c = 2$

$$\frac{-1.8 \pm \sqrt{(1.8)^2 - 4(-.015)(2)}}{2(-.015)}$$

$$\frac{-1.8 \pm \sqrt{3.24 + .12}}{-.03}$$

$$\frac{-1.8 \pm \sqrt{3.36}}{-.03}$$

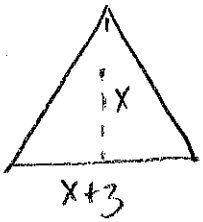
$$\frac{-1.8 + \sqrt{3.36}}{-.03} \qquad \frac{-1.8 - \sqrt{3.36}}{-.03}$$

$= -1.\cancel{X}$ $\qquad = 121.1$

The ball travels about 121 feet.

#8

Pizzazz

① 

$A = \frac{bh}{2}$

$2\left(\frac{x(x+3)}{2}\right) = (35)2$

$x^2 + 3x = 70$

$x^2 + 3x - 70 = 0$

$(x+10)(x-7) = 0$

$x+10=0 \quad x-7=0$

$x = -10 \quad x = 7$

-70 / 10 / -7 / 3

The altitude is 7 cm.

② 

$A = \frac{bh}{2}$

$2\left(\frac{x(x-2)}{2}\right) = (15)2$

$x^2 - 2x = 30$

$x^2 - 2x - 30 = 0$

$a = 1$, $b = -2$, $c = -30$

$\frac{2 \pm \sqrt{(-2)^2 - 4(1)(30)}}{2(1)}$

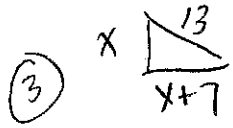
$\frac{2 \pm \sqrt{4+120}}{2}$

$\frac{2 \pm \sqrt{124}}{2}$

$\frac{2+\sqrt{124}}{2} \quad \frac{2-\sqrt{124}}{2}$

$= 6.6 \quad = -4.6$

The base is 6.6 cm.

③ 

$x^2 + (x+7)^2 = 13^2$

$x^2 + x^2 + 14x + 49 = 169$

$2x^2 + 14x - 120 = 0$

$2(x^2 + 7x - 60) = 0$

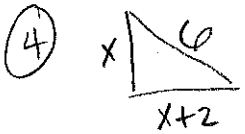
$2(x+12)(x-5) = 0$

-60 / 12 / -5 / 7

$2 \neq 0 \quad x+12=0 \quad x-5=0$

$x = -12 \quad x = 5$

The shortest side is 5m.

④ 

$x^2 + (x+2)^2 = 6^2$

$x^2 + x^2 + 4x + 4 = 36$

$2x^2 + 4x - 32 = 0$

$2(x^2 + 2x - 16) = 0$

$a = 1$, $b = 2$, $c = -16$

$\frac{-2 \pm \sqrt{2^2 - 4(1)(-16)}}{2(1)}$

$\frac{-2 \pm \sqrt{4+64}}{2}$

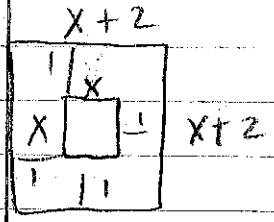
$\frac{-2 \pm \sqrt{68}}{2}$

$\frac{-2+\sqrt{68}}{2} \quad \frac{-2-\sqrt{68}}{2}$

$3.1+2 = 5.1 \quad = 3.1 \quad = -5.1$

The dimensions are 3.1 m x 5.1m.

(5)



$3\left(x^2 = \frac{2}{3}(x+2)^2\right)$

$x^2 = \frac{2}{3}(x^2+4x+4)$

$3x^2 = 2(x^2+4x+4)$

$3x^2 = 2x^2+8x+8$

$-2x^2 \quad -2x^2 \quad -8x \quad -8$

$x^2 - 8x - 8 = 0$

$a=1$, $b=-8$, $c=-8$

$\frac{8 \pm \sqrt{(-8)^2-4(1)(-8)}}{2(1)}$

$\frac{8 \pm \sqrt{64+32}}{2}$

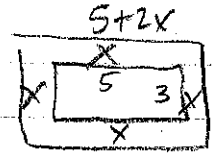
$\frac{8 \pm \sqrt{96}}{2}$

$\frac{8+\sqrt{96}}{2} = 8.9$ $\quad \frac{8-\sqrt{96}}{2} = -\cancel{0.89}$

A side of the picture is 8.9 cm.

The side of the smaller tile is ≈ 4.4 cm.

(4)



$(2x+5)(2x+3) = 39$

$4x^2+10x+6x+15 = 39$

$4x^2+16x+15 = 39$

$4x^2+16x-24 = 0$

$4(x^2+4x-6) = 0$

$a=1$, $b=4$, $c=-6$

$\frac{-4 \pm \sqrt{4^2-4(1)(-6)}}{2(1)}$

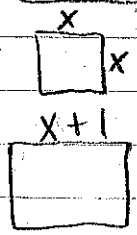
$\frac{-4 \pm \sqrt{16+24}}{2}$

$\frac{-4 \pm \sqrt{40}}{2}$

$\frac{-4+\sqrt{40}}{2} = 1.16$ $\quad \frac{-4-\sqrt{40}}{2} = -\cancel{5.16}$

The walk is 1.2 m

(7)



$400x^2 = 400(x^2+2x+1)$

$400x^2 = 400x^2+800x+400$

$200x^2 - 800x - 400 = 0$

$200(x^2-4x-2) = 0$

$\frac{4 \pm \sqrt{(-4)^2-4(1)(-2)}}{2(1)}$

$\frac{4 \pm \sqrt{24}}{2}$ → $\frac{4+\sqrt{24}}{2} = 4.449$ ✓

$\frac{4-\sqrt{24}}{2} = -\cancel{0.449}$